TECHNICAL SPECIFICATION

ISO/TS 17536-3

First edition
2014-12-01

Road vehicles — Aerosol separator performance test for internal combustion engines —

Part 3: Method to perform engine gravimetric test

Véhicules routiers — Essai de performance du séparateur d'aérosols pour les moteurs à combustion interne —

Partie 3: Méthode pour effectuer un essai gravimétrique du moteur

Reference number
ISO/TS 17536-3:2014(E)

ISO copyright office
Case postale 56 • CH-1211 Geneva 20
Tel. + 41 22 749 01 11
Fax + 41 22 749 09 47
E-mail copyright@iso.org
Web www.iso.org

Published in Switzerland

Contents

Page

Foreword

ISO (the International Organization for Standardization) is a worldwide federation of national standards bodies (ISO member bodies). The work of preparing International Standards is normally carried out through ISO technical committees. Each member body interested in a subject for which a technical committee has been established has the right to be represented on that committee. International organizations, governmental and non-governmental, in liaison with ISO, also take part in the work. ISO collaborates closely with the International Electrotechnical Commission (IEC) on all matters of electrotechnical standardization.

The procedures used to develop this document and those intended for its further maintenance are described in the ISO/IEC Directives, Part 1. In particular the different approval criteria needed for the different types of ISO documents should be noted. This document was drafted in accordance with the editorial rules of the ISO/IEC Directives, Part 2 (see www.iso.org/directives).

Attention is drawn to the possibility that some of the elements of this document may be the subject of patent rights. ISO shall not be held responsible for identifying any or all such patent rights. Details of any patent rights identified during the development of the document will be in the Introduction and/or on the ISO list of patent declarations received (see www.iso.org/patents).

Any trade name used in this document is information given for the convenience of users and does not constitute an endorsement.

For an explanation on the meaning of ISO specific terms and expressions related to conformity assessment, as well as information about ISO's adherence to the WTO principles in the Technical Barriers to Trade (TBT), see the following URL: Foreword — Supplementary information.

The committee responsible for this document is ISO/TC 22, *Road vehicles*, Subcommittee SC 5, *Engine tests*.

ISO 17536 consists of the following parts, under the general title *Road vehicles — Aerosol separator performance test for internal combustion engines*:

— *Part 1: General*

— *Part 3: Method to perform engine gravimetric test* [Technical Specification]

The following parts are under preparation:

— *Part 2: Laboratory gravimetric test method*

— *Part 4: Laboratory fractional test method*

— *Part 5: Engine fractional efficiency test method*

Introduction

Engine crankcase blowby is composed of combustion exhaust gases which have escaped to the crankcase through piston ring seals and lube oil aerosols generated by thermal and mechanical action within the engine. These gases are vented from the crankcase to prevent a build-up of high pressure. The constituents of vented engine blowby gases are recognized as an undesirable contaminant and technology for their containment is, therefore, evolving.

The device used to separate oil aerosols from the blowby typically releases cleaned gases to atmosphere, or alternatively returns the cleaned product to the combustion process by feeding into the air inlet, prior to the turbo compressor. The latter has led to the requirement for a pressure control device to isolate the engine from turbo inlet suction.

It is the purpose of this part of ISO 17536 to define standardized and repeatable test procedures for the evaluation of blowby oil aerosol separators and filtering devices using this engine gravimetric test method. This part of ISO 17536 is only a general guideline for performing an engine test.

Road vehicles — Aerosol separator performance test for internal combustion engines —

Part 3: Method to perform engine gravimetric test

1 Scope

This part of ISO 17536 defines standardized and repeatable test procedures by using internal combustion engines for the evaluation of blowby oil aerosol separators and specifies engine gravimetric separation efficiency and system pressure tests in both open and closed crankcase ventilation systems.

Filter life is not evaluated in this part of ISO 17536.

Conformance of a device to legislation is outside of the scope of this part of ISO 17536 and the appropriate regulations are to be consulted.

2 Normative references

The following documents, in whole or in part, are normatively referenced in this document and are indispensable for its application. For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments) applies.

ISO 17536-1:—[1], *Road vehicles — Aerosol separator performance test for internal combustion engines — Part 1: General*

3 Terms, definitions, symbols, and units

For the purposes of this document, the terms and definitions given in ISO 17536-1 apply.

4 Measurement accuracy

The measurement accuracy of this part of ISO 17536 shall be in accordance with ISO 17536-1:—, Clause 3.

5 Test materials and test conditions

5.1 Test oil and aerosol

The aerosol produced by the engine will be measured by volume flow rate. A graph of the droplet size distribution can be documented and displayed in particle size (µm) versus volume percent less than stated size. If a distribution exists, inclusion in the report is suggested.

Aerosol concentration will be measured by collecting the total flow of challenge aerosol with an absolute filter and wall flow trap.

The engine oil shall be documented for manufacturer, name, and make.

The oil and aerosol results shall be documented in the test report in Annex A.

1) To be published.

5.2 Absolute filter, wall flow trap, and leakage

The provisions related to the absolute filter, the downstream wall flow trap, and leakage shall be in accordance with ISO 17536-1: —, Clause 4.

5.3 Test conditions

Flow rate for efficiency tests shall be recorded in volumetric flow. All engine efficiency tests shall be documented with actual on-engine blowby temperature, absolute pressure, and humidity.

6 Test procedure

6.1 General

Gravimetric efficiency test shall be performed on a complete aerosol separator assembly.

6.2 Test equipment

NOTE The definitions of the following terms related to the test equipment are defined in ISO 17536-1: —, Clause 2: upstream particle counter, particle counter calibration, maximum particle concentration, and particle counter flow.

6.2.1 Setup arrangement to determine the efficiency is shown in Figure B.1. Use an engine to meter oil mist to the crankcase ventilation system.

6.2.2 Use a manometer or other differential pressure measuring device with the specified accuracy.

6.2.3 Orientation of the unit under test shall be as in application.

6.2.4 Use a wall flow trap between the unit under test and the outlet piezometer tube to eliminate any oil flow to the piezometer. Use a wall flow trap similar to ISO 17536-1: —, Figures I.1 and I.2.

6.2.5 Use a piezometer conforming to ISO 17536-1: —, Figure B.2. The cross-section shall be the same as the aerosol separator outlet. In the case of non-uniform flow conditions caused by special shaped tubes, special precautions might be required.

6.2.6 Use an air flow rate measuring system having the accuracy described in Clause 4. Use a system that is capable of holding the RPM and torque described in Clause 4.

6.2.7 If the engine is not capable of generating the blowby flow rate requested, use compressed air/blower/exhauster for inducing air flow through the system, to adequately generate a flow rate and pressure characteristics for the filters to be tested. Pulsation of flow rate shall be so low that it is not measurable by the flow rate measuring system.

6.2.8 If the components downstream of the unit under test and the environment have a pressure drop greater than 100 Pa, a blower/exhauster on the downstream of the system shall be used to regulate the outlet pressure of the unit under test.

6.2.9 Grounding is required for all test apparatus to reduce the effects of static charges and to improve the consistency of the test results. Grounding of metallic and non-metallic surfaces, housings, transport tubes, injectors, and associated hardware is recommended.

6.3 Gravimetric efficiency test

6.3.1 The purpose is to determine the gravimetric separation efficiency of an aerosol separator while mounted to an engine. The weight changes of the component parts and the absolute filter during the time period are used to calculate the gravimetric efficiency. An alternative method for capturing the total challenge can be conducted by removing the unit under test and the downstream wall flow trap and collecting all the mass on the absolute pad.

NOTE 1 A mass increase of more than 0,5 g has been shown to improve reliability of gravimetric engine testing.

NOTE 2 The mass feed rate is dependent on the engine operating conditions of that specific engine.

6.3.2 Weigh and record the unit under test.

6.3.3 Weigh and record the drainage vessel, if applicable.

6.3.4 Weigh the absolute filter as specified in ISO 17536-1: —, 4.1.2 and record mass before assembly in the absolute filter housing.

6.3.5 Weigh the downstream wall flow trap of the unit under test as specified in ISO 17536-1: —, 4.2.1, if applicable.

6.3.6 Setup the test stand as shown in Figure B.1 for all aerosol separators. Seal all joints to prevent air leakage.

6.3.7 Verify and document the required oil level, record the oil run time, engine run time, and ambient temperature, pressure, and humidity.

6.3.8 Start and bring the engine to the RPM and load condition or start the measurement at a particular RPM and load, as specified in 6.2.8. Record the oil temperature, blowby temperature, differential pressure, and crankcase pressure.

NOTE 1 Warm up of engine to a customer prescribed condition is intended to be completed prior to this step.

NOTE 2 Certain care is practiced to minimize the amount of exposure of the weighed equipment prior to the start of the gravimetric efficiency test, such as a by-pass valve system.

6.3.9 The differential pressure shall be compensated for the increased differential pressure that the tubing and downstream wall flow trap between the unit under test and the piezometer tubes introduce, since the downstream wall flow trap will be in this area. The downstream wall flow trap is present to protect the downstream piezometer tube from contamination of liquid oil wall flow.

6.3.10 Every 10 min, record the oil temperature, blowby temperature, differential pressure, and crankcase pressure at the engine condition and the elapsed test time.

6.3.11 Record the differential pressure at the end of test before interrupting either the RPM or torque to remove the absolute filter.

6.3.12 Stop the engine or measurement system.

6.3.13 Record the ambient temperature, pressure, and relative humidity.

6.3.14 Carefully weigh the unit under test without losing any oil. Note any evidence of seal leakage or unusual conditions. Weigh the unit. The increase in mass of the unit under test is the mass minus the mass recorded in 6.3.2.